Intention and Slips of Action

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意図と行為のスリップ

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People sometimes encounter slips of action in their daily life. For example, while making tea, one may make an error of putting some tealeaves into a cup, not into a teapot. This example illustrates what slips of action are. That is, the intended action is to put tealeaves into the teapot, but the executed action is to put them into the cup. Therefore, slips are the errors that an action is carried out against the intention. In other words, slips are “actions not as planned” (Reason, 1979). Slips are not the only errors that people make. It has been widely recognized that the errors are classified into two types according to the phase at which they occur[1] (e.g., Norman, 1981). One is a mistake that is a failure in the intention (or planning) phase. The other is a slip that occurs in the execution phase. This article focuses on slips of action, especially those of motor action. To begin with, I describe previous studies of action slips, which aim to categorize various slips. Next, I draw attention to the issue that has been neglected by the previous studies. To clarify the issue, I discuss the relation of intention and action. Then, I review studies of microslips to address the issue. Finally, I raise some questions about microslips and propose a new framework for studying them.

Studies on Categorization of Action Slips

One of the earliest investigations into the nature of slips was made by Freud (1901/1965). Whereas his studies on slips of the tongues are well known, Freud also studied action slips in the daily life of normal people. The main claim of Freud's study was that there is an unconscious intention behind the slips of action. Freud classified action slips into two types : *bungled actions* and *chance actions* (or *symptomatic actions*). Bungled actions refer to the case in which the failure of achieving an original goal seems to be crucial. In the case of bungled actions, seemingly awkward movements achieve a hidden intention in a skillful way. Freud pointed out that dropping, upsetting, or breaking objects is often used to express unconscious thoughts. On the other hand, chance actions refer to the case in which the whole action seems to be aimless. Although they appear to have no prior intention and to happen quite accidentally, they also have an unconscious intention. As Freud argued, these two types of slips are not exclusive, and therefore his classification is not useful in categorizing action slips. Rather, the significance of Freud's study lies in showing that action slips do not occur by accident but do occur by a certain underlying mechanism (for contemporary interpretation of Freudian slips, see Birnbaum & Collins, 1992, and Miller, 1991).

First comprehensive categorization of action slips was done by Norman (1981). Norman classified action slips based on an activation-trigger-schema system model. In this model, a given action sequence is completed by a number of schemata, which are represented at different levels, from the highest level to the lowest one. The highest-level parent schema represents intention, whereas lower-level child schemata control the action sequence. Once the highest-level schema is activated, lower-level schemata are also activated automatically. However, the activation of a schema alone cannot execute an action. To complete the action sequence, activated schemata must be triggered, and this requires satisfaction of trigger conditions. In sum, an action sequence consists of three stages : (a) the formation of intention, (b) activation of schemata that constitute components of the action sequence, and (c) triggering activated schemata to execute the action sequence.

According to Norman (1981), action slips are categorized with reference to three major sources that correspond to the three stages of action sequences. The first source of action slips is the formation of intention. During the formation of intention, not all errors are classified as slips. Errors in decision making and problem solving are classified as mistakes. However, there are still two types of errors that are categorized as action slips : mode errors (errors in classifying the situation) and description errors (errors that result from incompletely specified intention). The second source is the activation of schemata. Slips that result from faulty activation of schemata are divided into the subcategories of unintentional activation and loss of activation. Unintentional activation causes an action to intrude where it is not expected, and this class of error includes capture errors, data-driven activation, and associative activation. Loss of activation leads to omission of its components of the action sequence, and this class includes loss of intention and misordering, skipping, and repeating steps in an action sequence. The third source is triggering of schemata. Slips that result from faulty triggering of activated schemata are divided into the subcategories of false triggering and failure to trigger. False triggering is the error that a proper schema is triggered at an inappropriate time, and this class comprises spoonerisms, blends, intrusions of thought, and premature triggering. Failure to trigger is the error that an activated schema has not been invoked for some reasons.

In Norman's study, a theory of schema plays a major role. This is also true of Reason's (1990) study. According to Reason, correct performance is realized by activating the right schemata in the right order at the right time. Schemata require a certain level of activation to set them in action. The sources of activation are generally classified into two classes : specific activators and general activators. Specific activators, which include current intention, present context and related schemata, set a particular schema in motion at a specific time. General activators refer to general factors that provide background activation to schemata regardless of the current intention or context, which include recency, frequency, attributes shared with other schemata and emotional or motivational factors. These two activators call schemata into operation, and control an action sequence automatically.

Reason's (1990) approach to action slips is a part of his generic approach to human errors, a Generic Error Modeling System (GEMS). This model is largely dependent on Rasmussen's (1983) classification of human performance levels. According to Rasmussen, there are three levels of human performance : the skill-based level, the rule-based level, and the knowledge-based level. At the skill-based level, human permanence is based on feed-forward control and preprogrammed instructions. At the rule-based level, human performance is governed by stored rules like productions (if-then forms). At the knowledge-based level, typically in the novel situations, human performance requires planning on line, using conscious analytical processes and stored knowledge. Based on this classification, Reason categorized human errors into three types : skill-based slips (or lapses), rule-based mistakes, and knowledge based mistakes. Only skill-based slips are the concern of this article, and discussed further.

Reason (1990) argued that skill-based slips are generally related with attentional failures. These failures can be classified into two groups : inattention, failing to make the necessary attentional monitoring at critical points, and overattention, making an attentional check at an inappropriate point in an automatized action sequence. Each of these failures can take different forms of error. For example, slips caused by inattention include double-capture slips (e.g., intending to take off only shoes, but taking off socks as well), omissions associated with interruptions (e.g., program counter failures, Reason & Mycielska, 1982), reduced intentionality (e.g., the *what-am-I-doing-here* experience), perceptual confusions (e.g., picking up the squash bottle instead of the milk bottle), and interference errors (e.g., blends and spoonerisms). On the other hand, overattention causes omissions or repetitions, occasionally reversals, of parts of the action sequence.

Norman and Reason focused on the role of schemata in their classification of action slips, but Heckhausen and Beckmann (1990) centered on the role of intention. According to Heckhausen and Beckmann, actions are guided by mentally represented intentions. These intentions are divided into goal intentions and instrumental intentions. Goal intentions are the higher-level intentions that represent goals to be attained through actions. Instrumental intentions are the lower-level intentions that are directly connected to an action. Thus, goal intentions correspond to parent schemata and instrumental intentions to child schemata in Norman's (1981) sense.

To categorize action slips, Heckhausen and Beckmann (1990) distinguished between two modes for conscious processing of goal representations : wide-spanned goal representation and implementation-imminent (or narrow-spanned) goal representation. The mode of wide-spanned goal representation is automatic or open loop processing, and the mode of implementation-imminent goal representation is controlled or closed loop processing. According to Heckhausen and Beckmann, these two control modes set the stage for the occurrence of action slips. The wide-spanned goal representation may cause sidetracking and overlapping actions, whereas the implementation-imminent goal representation may lead to interpolated action. Thus, there are three error-generating conditions (sidetracking, overlapping and interpolation) corresponding with specific action slips. Sidetracking causes errors of initiation. Initiation errors include sidetracking during related overlapping, missing an opportunity, not recognizing an opportunity, pouncing on an inappropriate occasion, and falsely specifying initiation act. Overlapping results in errors in termination. Termination slips (deactivation slips) include prematurely terminating intention-guiding actions, prematurely deactivating initiation intentions, and continuing or repeating superfluous activities. Interpolation brings about errors of implementation (premature triggering). Implementation slips include triggering slips leading to skipping or repetition, substituting by double act-object coordination, falsely specified implementation acts, getting vividly anticipated implemental acts out of sequence, and relapsing during relearning.

Most studies of action slips have come from naturalistic observations of everyday activities. Although such studies provide rich and natural data, they face several difficulties. To begin with, it is difficult to manipulate the situations in which slips occur. Without a systematic manipulation of the various factors, it is difficult to achieve scientifically satisfactory causal explanation (Reason, 1990). Furthermore, there are difficulties in classifying particular slips. Any theory of action slips depends, more or less, on the observations that the researcher collected. Thus, some types of slips are classified properly, whereas others are not. Finally, the previous studies of action slips have neglected an important aspect of slips. This is because these studies depend on an inadequate theory of action. To illustrate what have been ignored, I will discuss the relation of intention to action.

Intention and Action

The problems about intention and action have traditionally been discussed at a branch of philosophy called "action theory" (Juarrero, 1999). Traditional action theories have assumed that intentions are mental states that cause actions (cf. Reed, 1993). This assumption consists of two claims : that intentions are mental states and that intentions are causes of action. Both claims, however, are open to question.

The first claim that intentions are mental states is doubtful because the systems that do not seem to have mental representations exhibit some intentional behaviors. One example of such systems is the nest construction of termites (Kugler, Shaw, Vicente & Kinsella-Shaw, 1991 ; Kugler & Turvey, 1988 ; for another example of two way of house building, see Maturana, 1980). African termites build nests that stand more than 15 feet in height, weigh more than 100 tons, and persist more than 300 years. Needless to say, the termites do not have a plan of the nest in advance. The termites, moreover, do not work through direct communication of each other. What controls the termites' behavior is the product of previous work (Grassé, 1959). As the termites put materials excreted by them, the density of pheromone around the building site increase. This densification attracts the termites, and again the termites deposit materials around the site. Grassé coined the term "stigmergy" to describe this process. Stigmergy means the stimulation to work by the very product of work. Stigmergy explains the behaviors of social insects without planning or communication (for application to robotics, see Beckers, Holland & Deneubourg, 1994).

It is clear that the termites do not represent a plan of the nest construction in mind. However, the termites' behavior is not random or inaccurate ; they are regulated and precise. To behave accurately and adaptively, the termites require the capability to select a proper goal. Goal selection is a fundamental feature of intention. From an ecological point of view, intention can emerge whenever there is a possibility of choice among affordances (Reed, 1993). Consequently, it may well be said that the nest-building behavior of termites is intentional, although the termites do not have mental representations.

Kugler et al. (1991) proposed that systems that exhibit intentional behavior can be divided into intentional systems[2] and intending systems. Intentional systems are systems that merely have intentions. Such systems do not have the ability to intend the behavior, but do have the ability of implicit goal-selection. On the other hand, intending systems have the ability to formulate intentions in the cognitive sense. Such systems have the ability of explicit goal-selection. Thus, intending systems are capable of true choice behavior. Whereas intentional systems only have some power of discrimination and selectivity in guiding their behavior, intending systems have some comprehension of cause and effect or of means-end relationships (Reed, 1996). Consequently, intending systems may have some mental representation of intention, whereas intentional systems do not.

The second claim that intentions cause actions seems to be supported by such a counterfactual : If one had not intended to do a certain action, one would not have done such an action (Searle, 1980). This counterfactual, however, is not always true. In fact, an action can be done without forming an intention to do it beforehand. If intentions are causes of actions, intentions should be formed prior to the execution of the action. Searle claimed that it is necessary to distinguish those intentions that are formed prior to actions from those that are not. The cases where an actor has the intention to perform the action prior to the execution of the action itself are called prior intentions. However, not all intentions are like that. For example, when a man suddenly hit another man, the man first might not have formed the intention to hit him. The man just hit him. Even in such a case, the man hit him intentionally and the action of hitting was done with the intention of hitting him. In such a case, the intention resides only in the action itself, and the action and the intention are inseparable. Intentions in such a case are called *intentions in action*. According to Searle, prior intentions and intentions in action have different linguistic forms of expression. The form of expression of a prior intention is "I will do A" or "I am going to do A". The form of expression of an intention in action is "I am doing A".

Searle (1980) argued that there are at least two ways to separate intentions in action from prior intentions. The first is to note that one performs many of the actions quite spontaneously, without forming, consciously or unconsciously, any prior intention to do those things, as shown in the previous example of hitting. A second way is to note that even in cases where one has a prior intention to do some action, there will be many subsidiary actions that are not represented in the prior intention. In executing well-practiced action sequence, only the major headings are likely to be specified in the prior intention ; the details of action sequence are unnecessary in advance. Furthermore, Searle claimed that all intentional actions have intentions in action but not all intentional actions have prior intentions. It seems plausible that prior intentions are prerequisite to performing intentional actions. However, one can do something intentionally without forming a prior intention to do it. Moreover, despite having formed a prior intention to do something, one does not act on that intention. Therefore, it should be concluded that prior intentions are not causes of action.

Juarrero (1999) also classified intentions into two types : prior intentions and *proximate intentions*. Juarrero's account of action depends largely on dynamical systems theories,[3] and therefore, describes intentions in the language of dynamical systems. According to Juarrero, intentional actions are nonlinear dynamical systems and represented in the state space structured by various constraints, external or internal. Prior intentions reorganize that state space into a more differential and complex set of options. Once an agent forms a prior intention, it is no longer necessary for that agent to consider every possible alternative. Thus, forming a new prior intention is the self-organizing process that reduces the number of possible options by organizing them into meaningful groupings. Even if prior intentions restructure a multidimensional phase space, there are some alternatives for actions. The agent must choose one of the alternatives. Proximate intentions play a decisive role in that phase. Juarrero proposed that formulating a proximate intention is the counterpart of the positioning of a particular attractor just ahead of the system's immediate position. When forming a proximate intention, the dynamical structure of prior intention entrains previously constructed motor control attractors. In entraining these attractors, the proximate intention constrains motor control so that the behavior described by the intention will be carried out. Juarrero claimed this mechanism is an implementation of Searle's intentions in action. In sum, formulating a proximate intention is the construction of a new attractor, or the deepening of an existing one, and its placement just a head of the agent's current state. In other words, whereas prior intentions are self-organized dynamics within a state space, proximate intentions are control knobs governing that space.

Judging from the above, intentions are not always formed prior to actions. In some cases, intentions are formed at the very time when action is executed. I call intentions in such cases *emergent intentions* because they seem to emerge in the course of action. Emergent intentions are always included in intentional actions, but prior intentions are not. As I noted, intending systems have the capacity of intending, and thus they can have prior intentions. Intentional systems, however, cannot have prior intentions. They have only emergent intention. The claim that intentions include not only prior intentions but also emergent intentions is a critical point that the previous studies on action slips lack.[4] The reason that the previous studies have ignored emergent intentions may be that they have relied on naturalistic observations. In naturalistic studies, the data of slips are collected as verbal reports of actors. In general, actors are conscious of what was intended, but they are rarely conscious of what was intentional. Consequently, verbal reports contain prior intentions but no emergent intentions.

Microslips as Manifestation of Emergent Intentions

The studies on action slips discussed in the earlier section have dealt with the slips that are deviated from prior intentions, not from emergent intentions. Well then, what are slips deviated from emergent intentions ? One of such candidates is *microslips*[5] (Sasaki, Mishima, Suzuki & Ohkura, 1995 ; Sasaki & Suzuki, 1994 ; Suzuki, Mishima & Sasaki, 1997). Microslips are small-scale modifications of motor actions, which were found in the task of making instant coffee. Four microslips were found : *hesitations, trajectory changes, touches*, and *hand shape changes*. Hesitations occur when the hand moving toward an object pauses for an instant, and then moves toward it again. Trajectory changes are the case when the hand moving toward a certain object suddenly changes its trajectory on the way, and then move toward another object. Touches are the phenomena that before acting on a certain object, the hand makes a light contact with an irrelevant object. For instance, a person slightly touches a cup close at hand before reaching a cup at a distance. Hand shape changes occur when the hand moving toward an object suddenly changes its shape just before grasping the object. For example, the hand, which has been widely open to grasp the brim of a cup, rapidly changes its shape to grasp the ear of the cup just before reaching the cup. Sasaki and Suzuki (1994) argued that these microslips have their specific duration. Because microslips have rather short duration, the movement does not appear to stop completely. However, the duration of microslips are long enough to be observable to the naked eyes; thus no need of a slow-motion video clip. In short, microslips are slips of the hand that are rapid but observable to the naked eyes.

Several findings were obtained from the observations on microslips (Sasaki et al., 1995; Sasaki & Suzuki, 1994; Suzuki et al., 1997). First, the complexity of the environment influences the frequency of microslips. Sasaki et al. made a comparison of microslips between the simple condition, where only necessary items for making coffee (i.e., coffee grinds, spoons, empty cups, etc.) were placed on the desk, and the complex condition, where irrelevant items (i.e., coffee beans, forks, mayonnaise, etc.) as well as the necessary ones were placed on the desk. As compared to the simple condition, the complex condition caused to take more time and to make more microslips. Secondly, the repetition of the task reduces the number of microslips. Sasaki et al. asked the participants to repeat the coffee-making task three times. The results showed that the number of microslips on the first trial was more than those on the second and the third trials. However, the repetition of the task did not remove microslips completely. Thirdly, the aging effects on the occurrence of microslips were found. School children, undergraduates, and old people were asked to make coffee (or cocoa for school children) in the complex condition. The results demonstrated that undergraduates tended to make less trajectory changes than the other groups and that old people made more touches than the other groups. Finally, microslips does not occur at random, but occur at specific situations. Sasaki et al. made a close examination on microslips according to the "action coding system", which was devised to describe activities of daily life (Mayer, Reed, Schwartz, Montgomery & Palmer, 1990; Schwartz, Reed, Montgomery, Palmer & Mayer, 1991). Owing to this method, Sasaki et al. found that half of the microslips occurred at the transition period of subgoals and furthermore that many microslips occurred successively within less than five seconds. That is, microslips are likely to take place successively at the point where one subgoal shifts to another.

I would like to claim that microslips are manifestation of emergent intentions for the following reasons. First, microslips seem to reflect the alteration of intention. Taking an example of trajectory change, the hand that has been moving toward a certain object abruptly changes its trajectory to move toward another object, which suggests that the intention has changed on the way. The occurrence of microslips may imply that a new intention emerges in the course of action. The new intention does not exist prior to action, thus it must be an emergent intention. Secondly, the time scale in which microslips occur is rather small. Microslips have shorter duration than the other slips of action. This implies that microslips have a tight contact with ongoing actions. Because ongoing actions include emergent intentions, microslips have to do with emergent intentions. Finally, most actors do not notice microslips. This is a remarkable contrast to other slips of action. Whereas most action slips are detected by actors themselves, microslips are usually detected by observers. Thus, it seems that actors do not have a conscious prior intention in making microslips.

A Redefinition of Microslips

Despite the significance of microslips for the studies of intention and action, I would suspect that the categorization of microslips aforementioned has some problems. One is that the categorization does not appear to be exhaustive. One may wonder why microslips fall into four types. Suzuki et al. (1997) argued that several subtle modifications of action might be identified as microslips, but the reliably observed microslips were of these four types : hesitations, trajectory changes, touches, and hand shape changes. However, this categorization of microslips seems to be haphazard because observable microslips may depend on the task situations. Other types of microslips might be found on tasks other than the coffee making. It is precarious to categorize microslips on the basis of observations alone. Another issue is that the categorization of microslips seems to be incoherent. Trajectory change, touch and hand shape change refer to motor actions, but hesitation does not refer to them ; rather, it refers to a certain mental state. To categorize microslips coherently, one must uniform the levels of description. A lack of coherence may be caused by a lack of theory. Therefore, one must categorize microslips according to a theory (or a principle) as well as observations.

To categorize microslips in an exhaustive and coherent way, one must keep in mind that microslips are small-scale modifications of motor action ; thus, microslips can be detected as nonsmooth movements.[6] A preferable categorization of microslips, therefore, should be based on the movement. Because microslips are slips of the hand, one must classify microslips with regards to the hand movement. In such an attempt, kinematics, the branch of mechanics concerned with motion, can provide a conceptual frame. If the hand is regarded as a material point, the hand movement is expressed as its velocity. The velocity is a vector quantity, thus it has two values : its magnitude, that is, speed, and direction. Speed and direction must be the two important indexes of microslips. Microslips can be detected as nonsmooth movements, and the movements that are observed as nonsmooth are not gradual but rapid changes. Therefore, microslips seem to be defined as rapid changes of speed and direction. In some cases, however, the hand is not regarded as a material point or a rigid body. The hand itself changes its shape. Taking this into account, microslips can be defined as rapid changes of speed, direction and shape of the hand.

Speed changes occur when the hand suddenly accelerates or decelerates in the course of movement. Thus, they include acceleration and deceleration. A momentary pause is a special case when the hand suddenly decelerates to stop, and then accelerates. Direction changes occur when the hand suddenly changes its direction in the course of movement. They can be subdivided into opposite direction and other direction. A typical opposite direction change is a withdrawal of the hand. Other direction changes occur when the hand moving toward an object abruptly changes its direction to another object. Shape changes occur when the hand swiftly changes its shape, typically on putting or taking an object. For example, in putting an object, the shape of the hand sometimes changes when adjusting finely the place or the direction of the object to be put. These three groups of motion change can serve as the criteria for categorizing microslips, but a microslip is not always classified as one of the groups ; rather, classification should be done in the combination of the groups.

At this point, four types of microslips discussed earlier can be redefined from the viewpoint just mentioned. Hesitations are considered to be a kind of speed changes. The process of hesitation includes sudden deceleration, pause and acceleration. Trajectory changes are thought to be a kind of direction changes. In some cases, trajectory changes include a speed change, for a rapid change of direction requires deceleration. Touches are also considered to be a kind of direction changes. What distinguishes between trajectory changes and touches is the place where a direction change occurs. In the case of touches, a direction change occurs on an object. As for trajectory changes, a direction change occurs in mid-air. Hand shape changes are equivalent to shape changes.

At a first sight, the classification based on the movement looks like that of previous studies of microslips. However, there are a few microslips that cannot be classified into these four types, although most microslips found in the coffee-making task can be classified into these four types. Furthermore, if the task situation is different, another type of microslips might be found. Thus, a reasonable classification must be based on a certain principle. The classification based on the movement can be useful in describing microslips.

It is worthwhile to mention, in passing, the grounds that microslips are detected as nonsmooth movements. One may insist that a microslip cannot be found out only from the motor action because, as has been noted, slips are deviations from what was intended. Can microslips be detected without identifying the intention concerned ? To relate microslips to motor actions, one must find a special mapping between intention and motor action. A solution to this problem has been proposed as psychological inverse dynamics (Shaw, Kugler & Kinsella-Shaw, 1990). Inverse dynamics is typically employed in classical mechanics. Inverse dynamics in mechanics defines a particular mapping between kinetic and kinematic parameters. For example, Newton's law $F=ma$ has a kinetic parameter *force* and a kinematic parameter *acceleration*. In this case, the mapping from kinetic states to kinematic states is one-to-one and thus the mapping has an inverse. In most situations, a force cannot be measured readily because its sources are usually hidden. However, the force may be inferred from the motions that can be more easily observed and measured. In the same way, psychological inverse dynamics defines a particular mapping between intention and action. An intention is difficult to measure, but may be inferred from actions that are readily available for measurement. In the case of motor action, an intention may be inferred from movements, and therefore microslips can be detected as nonsmooth movements.

Conclusions

In this article, I have attempted to discuss the role of intention in the studies on slips of action. I argued that previous studies of action slips have neglected an important aspect of intention, that is, emergent intentions, and that the studies of microslips focused on the issue. Nevertheless, the recent studies of microslips have not a theoretical foundation enough to be allowed for a consistent classification of slips. Then, I proposed a motion-based classification of microslips. This classification includes the changes of speed, direction, and shape. This classification, however, is rather speculative, thus empirical supports are necessary. Therefore, the future research must be addressed to the issues whether other types of classification of microslips is possible or not. To handle the issue requires the tasks other than coffee making. Norman (1981) insisted that studies on slips of action reveal the role of intention in a theory of action. Future research on microslips may shed light on the relation of intention and action.

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Notes

1 Reason (1990) classified unintentional actions into slips and lapses. Lapses are errors that occur in the storage phase where a plan or intention is stored in the memory. Whereas slips are observable as externalized actions, lapses are generally covert errors. This article deals with observable errors ; therefore lapses are not the present concern.

2 Intentional systems mentioned here are not those that Dennett (1987) referred to. There is some confusion about the meaning of "intentional". Intentional is an adjective of two nouns, intention and intentionality. In this article, intentional systems mean systems having intention, whereas Dennett argued intentional systems with relation to intentionality.

3 Dynamical systems theories have influenced many researchers in the field of cognition and

development (e.g., Newell & Molenaar, 1998; Port & van Gelder, 1995). However, I cannot discuss here for lack of space.

4 Reason (1990) referred to Searle's distinction between prior intention and intention in action, but did not relate intentions in action with action slips.

5 Microslips were firstly reported by Edward S. Reed. Unfortunately, the manuscript on microslips written by Reed and his colleague was not published. Therefore, I reviewed the research on microslips with reference to the works done by Sasaki and his collaborators.

6 Nonsmooth movements are not always categorized as slips. There are some sources that cause nonsmooth movements. These include perturbations by external forces (e.g., bumping against something), feints with intention (e.g., a deceptive movement in sport), and the nature of movement itself (e.g., *movement intermittency*, Doeringer & Hogan, 1998). Nevertheless, these sources are rarely seen in the task situations like coffee making.

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